Institute of Paper Science and Technology
Atlanta, Georgia

IPST Technical Paper Series Number 814

Quality, Quantity, Cost: Which is Your Driver?

A. Timberlake

August 1999

Submitted to
1999 TAPPI Engineering/Process & Product Quality Conference
Anaheim, California
September 12-16

Copyright© 1999 by the Institute of Paper Science and Technology

For Members Only

INSTITUTE OF PAPER SCIENCE AND TECHNOLOGY
PURPOSE AND MISSIONS

The Institute of Paper Science and Technology is an independent graduate school, research organization, and information center for science and technology mainly concerned with manufacture and uses of pulp, paper, paperboard, and other forest products and byproducts. Established in 1929, the Institute provides research and information services to the wood, fiber, and allied industries in a unique partnership between education and business. The Institute is supported by 52 North American companies. The purpose of the Institute is fulfilled through four missions, which are:

- to provide a multidisciplinary education to students who advance the science and technology of the industry and who rise into leadership positions within the industry;
- to conduct and foster research that creates knowledge to satisfy the technological needs of the industry;
- to serve as a key global resource for the acquisition, assessment, and dissemination of industry information, providing critically important information to decision-makers at all levels of the industry; and
- to aggressively seek out technological opportunities and facilitate the transfer and implementation of those technologies in collaboration with industry partners.

ACCREDITATION

The Institute of Paper Science and Technology is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award the Master of Science and Doctor of Philosophy degrees.

NOTICE AND DISCLAIMER

The Institute of Paper Science and Technology (IPST) has provided a high standard of professional service and has put forth its best efforts within the time and funds available for this project. The information and conclusions are advisory and are intended only for internal use by any company who may receive this report. Each company must decide for itself the best approach to solving any problems it may have and how, or whether, this reported information should be considered in its approach.

IPST does not recommend particular products, procedures, materials, or service. These are included only in the interest of completeness within a laboratory context and budgetary constraint. Actual products, procedures, materials, and services used may differ and are peculiar to the operations of each company.

In no event shall IPST or its employees and agents have any obligation or liability for damages including, but not limited to, consequential damages arising out of or in connection with any company's use of or inability to use the reported information. IPST provides no warranty or guaranty of results.

The Institute of Paper Science and Technology assures equal opportunity to all qualified persons without regard to race, color, religion, sex, national origin, age, disability, marital status, or Vietnam era veterans status in the admission to, participation in, treatment of, or employment in the programs and activities which the Institute operates.

QUALITY, QUANTITY, COST: WHICH IS YOUR DRIVER?

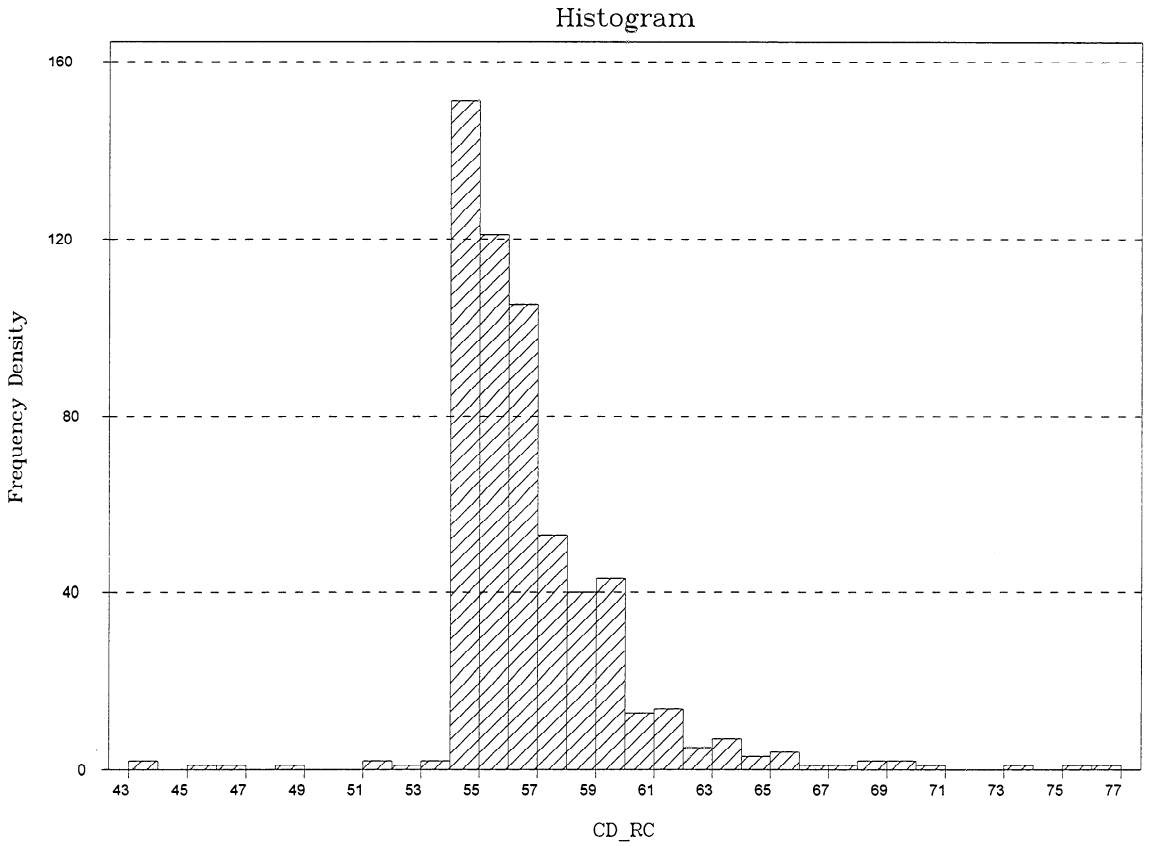
Ann Timberlake
Manager, Paper Analysis Lab
Institute of Paper Science and Technology
Atlanta, GA

ABSTRACT

We would all like to think that quality is the main driver in our organizations, but often that is not truly the case. There are some signals to look for in your operations. If you find that quality is not the main driver, how can this be changed? Some ideas from some experts are cited.

WHERE TO LOOK FOR CLUES

Make a histogram of a few months of test data for a variable that has a specification limit. Does it look like the histogram below?



The specification minimum is 54. Surprised? This is known as "flinching," when testers retest to get an acceptable result. Notice the extremely high number of results at 54. This is good evidence that your crew is more interested in getting out tonnage than in producing a quality product that pleases your customer, or perhaps there is one crew that "beats up" the laboratory testers when they deliver bad news. This is actual data from a paper company; they wanted

to know why their data from one machine looked like this when they did not see it in histograms of data from their other machines.

Does your organization practice "cost-cutting" rather than eliminating the causes of costs?

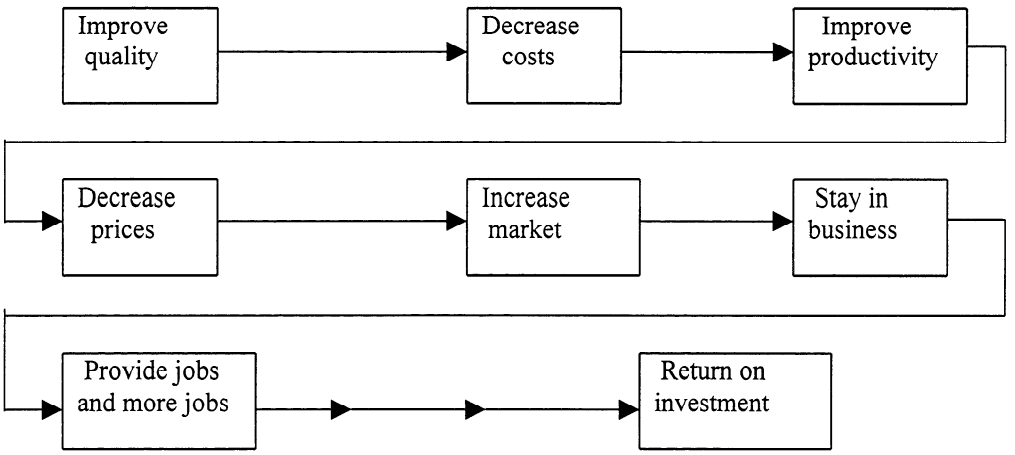
Is your organization managed by the monthly report?

Does your organization go for the "quick fix" and then forget to find the fundamental solution? Do the same problems reoccur periodically?

Are people in your organization rewarded for solving problems and "putting out fires"? Is being skilled at problem solving essential to managers?

WHAT DO THE EXPERTS SAY?

In 1950, while lecturing in Japan, Dr. Deming drew his famous chain reaction on the blackboard. Brian Joiner in *Fourth Generation Management* added the last step shown below.



DEMING CHAIN REACTION

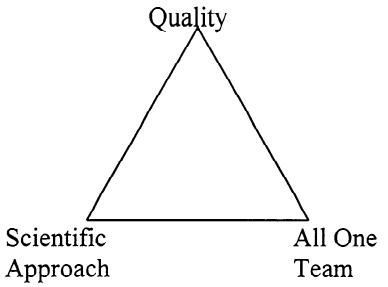
Dr. Deming said to work on quality. As we work on quality, we will be able to decrease costs and increase productivity. This allows us to decrease prices, increase our markets, stay in business, and provide more jobs.

For years, American manufacturers thought they had to choose between low cost and high quality. They thought that higher quality products cost more to manufacture, required more expensive materials, took longer to assemble, and required more extensive quality controls. If increased inspection were the only way they knew to improve quality, they were correct. However, they did not understand the profound difference between "cost-cutting" and eliminating causes of costs. By starting at "Decrease costs" rather than "Improve quality," we do not eliminate the *causes* of costs. One cost-cutting drive leads to further problems, which leads to another cost-cutting drive. They did not consider that quality and costs might *both* go up in the short-term because the full range of cost savings may take several years to come to fruition.

For decades, American manufacturers have also thought that if they wanted to improve productivity, they would have to make some sacrifices in quality. A common misconception has been that productivity and quality are incompatible, that you can have one or the other but not both. Productivity is not the same as production or quantity; it is not simply a measure of the volume of output. It is a measure of the efficiency of resource use, a ratio of outputs to inputs. The higher this ratio, the higher the productivity and the more efficiently resources are used. Increased

quality and productivity gains achieved through quality improvements are required to maintain market share and current profitability in today's business climate.

So, how can we "have our cake and eat it too"/ Brian Joiner proposes the Joiner Triangle. He defines the three



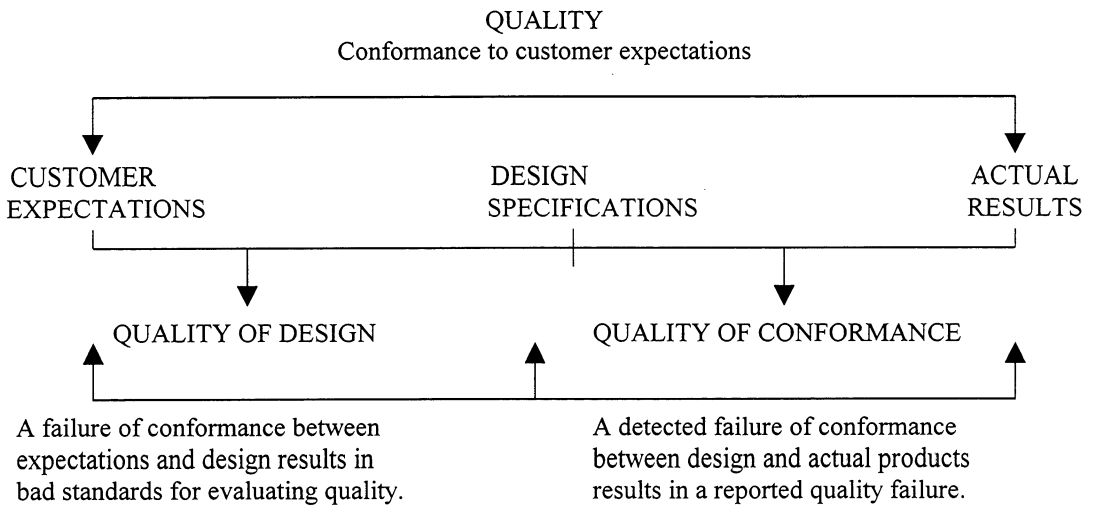
THE JOINER TRIANGLE

corners as:
Quality---Understanding that quality is defined by the customer; developing an obsession for delighting customers---not being satisfied with merely getting rid of what annoys them but going beyond to understand their current and future needs deeply, to surprise them with products and services they did not even know were possible. This understanding is no longer the domain of special groups within an organization; rather, it is shared with and further developed by every employee.
Scientific Approach---Learning to manage the organization as a system, developing process thinking, basing decisions on data, and understanding variation.
All One Team---Believing in people; treating everyone in the organization with dignity, trust, and respect; working toward win-win instead of win-lose for all stakeholders (customers, employees, shareholders, suppliers, the communities in which we live.)

Quality professionals often define *quality* as "conformance to customer expectations" or "fitness for use" where the intended use is determined by the customer. There are three primary determinants of quality in this context: customer expectations, product specifications, and actual results. Customer expectations seldom are expressed quantitatively. Morse, Roth, and Poston, in their book *Measuring, Planning, and Controlling Quality Costs*, cite four steps in making a product that conforms to customer expectations.

1. Restate qualitative customer expectations into quantitative *functional specifications*, quantitative statements regarding the capabilities of the product.
2. Develop *design specifications*, detailed statements regarding the physical characteristics of the product, for a product that meets the functional specifications.
3. Develop *manufacturing specifications* that specify in detail how the product is to be produced and what its physical characteristics should be at each step of the production process.
4. Manufacture the product using the manufacturing specifications.

There are two entirely different considerations in the determination of "fitness for use." *Quality of design* refers to the degree of conformance between customer expectations for the product and the design specifications for the product. Because the design specifications serve as the standard by which quality is measured, poor quality of design reduces the usefulness of the resulting performance measures and hinders the operation of the quality control system. *Quality of conformance* refers to the degree to which a given product or service conforms to its design specifications. Only when we are sure that we have high quality of design, may we expect that increasing quality of conformance will reduce costs and give us satisfied customers. These two possible sources of poor quality products are illustrated below.



QUALITY OF DESIGN AND QUALITY OF CONFORMANCE

A major benefit of a true customer focus is being able to identify and eliminate work that has little meaning or value to our customers. Productivity gains achieved by improving work processes often improve quality because employees can do their jobs in consistent ways every time, not having to repeatedly adapt their procedures depending on how the process is currently running. And, on the other hand, although there are many ways a manager might improve productivity, one clear approach is through an increased focus on quality of conformance.

Another aspect of Deming's "Improve quality" is constant improvement. Specifications are the voice of the customer, not the voice of the process. While specifications may be used to define when one is in trouble with regard to the voice of the customer, specifications do nothing to describe or define the voice of the process. Comparing products to specifications will not lead to improvement of the process and will not reveal any insights into how the process works. It will tell you where you are; it will not tell you how you got there, and it will not tell you how to get out of the mess in which you find yourself.

How do you fix the mess in which you find yourself? Brian Joiner says there are three "Levels of Fix."

1. *Fix the Output*---Promptly correct problems that appear in existing output or that occur during the delivery of a service.
2. *Fix the Process*---Change the process that allowed the problem to occur; develop ways to prevent its recurrence.
3. *Fix the System*---Change the system that allowed the faulty process (that led to the faulty product or service) to operate with these flaws.

Peter Senge in *The Fifth Discipline* says that well-intended "solutions" actually make matters worse over the long term. Opting for "symptomatic solutions" is enticing. Apparent improvement is achieved. Pressures, either external or internal, to "do something" about a vexing problem are relieved, but easing a problem symptom also reduces any perceived need to find more fundamental solutions. Symptomatic solutions must always be acknowledged as such *and* combined with strategies for rehabilitating the capacity for fundamental solution, which almost always requires a long-term orientation and a sense of shared vision. In other words, we must incorporate systems thinking into our very being. Systems thinking is a discipline for seeing wholes. Senge uses the analogy, "Dividing an elephant in half does not produce two small elephants. You don't have two small elephants then; you have a mess. By a mess, I mean a complicated problem where there is no leverage to be found because the leverage lies in interactions that cannot be seen from looking only at the piece you are holding."

Brian Joiner says, "We need to work together to optimize the system as a whole, not to seek to optimize separate pieces. Optimizing separate pieces destroys the effectiveness of the whole."

Donald Wheeler, in *Understanding Variation*, reminds us that the monthly report format for presenting results obscures the big picture and quotes Myron Tribus saying, "Managing a company by means of the monthly report is like trying to drive a car by watching the yellow line in the rear-view mirror."

Where do we find fundamental solutions? Go back to Dr. Deming; he captured most of them in his famous 14 Points!

CONCLUSIONS

Quality and quantity are two sides of the same coin, not opposing forces. Higher quality of conformance means lower rejection rates. Lower rejection rates mean higher efficiency of resource use. Higher efficiency of resource use means greater output for a given level of inputs, or increased productivity.

Viewing our organizations as systems helps us achieve a customer focus and reduce waste and inefficiency.

REFERENCES

1. Joiner, Brian L., *Fourth Generation Management*, New York, McGraw-Hill, Inc., 1994
2. Senge, Peter M., *The Fifth Discipline*, New York, Doubleday/Currency, 1990
3. Wheeler, Donald J., *Understanding Variation*, Knoxville, SPC Press, Inc., 1993
4. Morse, Wayne J., Roth, Harold P., and Poston, Kay M., *Measuring, Planning, and Controlling Quality Costs*, Montvale, NJ, Institute of Management Accountants, 1987